MITCHELL FIELD WATER TOWER ASSESSMENT

Report of Findings

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COMMITMENT & INTEGRITY DRIVE RESULTS

230515.00
Town of Harpswell, ME
March 2017

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1. BACKGROUND

The Town of Harpswell acquired the Mitchell Field property in 2001. The site, which was previously used as a fueling depot for the Brunswick Naval Air Station, consists of approximately 118.5 acres and contains infrastructure that was constructed by the U.S. government prior to the closure of the depot. This infrastructure includes components of a water system including a well, water tower, and an unused treatment building. The purpose of this report is to evaluate the value of re-using the existing water tower to future development on the site and present recommendations for improvements that would need to be made to the water tower should the town decide to maintain it. This report will also explore alternate methods of providing water to potential developments on the site.

Several reports have been completed to provide information and direction to the Town that will help guide the development of the site. The following previously completed documents were used in this assessment of the Mitchell Field Water Tower:

- The Mitchell Field Master Plan developed by Holt & Lachman, September 2007
- Preliminary Infrastructure Planning developed by DeLuca-Hoffman Associates, Inc., May 2012
- Tank Condition Assessment Report by Utility Service Group, July 2014
- Development Scenarios developed by Mark Eyerman, September 2016

2. EXISTING INFRASTRUCTURE

The existing water system consists of a water tower, well, and unused treatment building. The locations of these structures are shown on Figure 1.

2.1 Well

The Navy installed a well on the site in 2000. The well is permitted by Maine Department of Health and Human Services (DHHS) to supply approximately 17,300 gpd (12 gpm) but was restricted by Maine Department of Environmental Protection (MDEP) to a maximum withdrawal of approximately 9,000 gpd (6.25 gpm) due to the uncertainty of the movement of contaminants on the site. MDEP has since removed the restriction and completed its monitoring of contaminants on the site. MDEP is waiting to receive a closure letter from the U.S. Navy before fully releasing the site from its oversight.

The well would require treatment for iron and manganese according to Deluca-Hoffman's Preliminary Infrastructure Plan. Additional information about the well pump and potential connection to the existing tank would need to be obtained before activating the well.

2.2 Treatment Building

There is an 884 square foot treatment building located approximately 110 feet to the west of the tank that is currently unused. The Town believes the building houses two settling basins, however the treatment building is boarded up and internal inspection of the building was not possible during our initial site visit on September 30, 2016. The exact layout of the building and its interior condition is unknown.

The building, which was constructed more than fifty years ago, is obsolete and not suited for modern treatment systems. It would likely be more cost effective to construct a new structure to house the necessary treatment system if the existing well is brought on-line. Should the Town choose to demolish the existing building, a survey for lead and asbestos should be conducted prior to demolition and proper abatement procedures should be followed.

2.3 Water Tower

The existing welded steel water tower is capable of holding 100,000 gallons of water and was believed to be constructed around 1950. It's primary purpose while the US Navy was operating the site was to provide a fresh water supply to the naval buildings and tanker ships that unloaded fuel at the site. The water tower sits on the southeastern side of the property, approximately 3,500 feet from the existing Administration Building and proposed Marine Business District and approximately 200 feet from the proposed housing development.

Utility Service Group completed a Tank Condition Assessment in July 2014. They evaluated the structural integrity of the tank, the condition of the interior and exterior coatings, and other miscellaneous features of the tank. The full report can be found in Appendix A of this report.

Structurally, the overflow pipe and the foundations for the leg columns and the riser are in need of repair. There is some pitting and metal loss on the interior of the tank and the ladder on the interior of the tank is bent and degraded. The exterior ladder was repaired following the assessment in July 2014, but additional work may be necessary if the Town chooses to maintain the tank. The exterior coating of the tank tested positive for lead and is heavily weathered. The interior coating is also in need of repair. A full list of recommended improvements to the water tower vary based on the use of the tower. A list of the required recommended improvements for various scenarios can be found in Section 5.

2.4 Piping

The water piping that connected the tank to the waterfront structures has been removed and the size, configuration, and condition of the remaining pipe around the well and tank is unknown.

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JOB NO:	230515.00
DATE:	DEC 2016
SCALE:	
DES BY:	MKS
DRN BY:	MKS
CHK BY:	
FIGURE	1.dwg

TOWN OF HARPSWELL

MITCHELL FIELD WATER TOWER ASSESSMENT

FIGURE 1

3. WATER DEMANDS

In order to evaluate the value of the water tower to the water system, demand projections were developed by Harpswell Town Planner, Mark Eyerman. The possible site uses detailed in the Master Plan and the state design loadings for septic systems were used to develop the demand projections. Four different scenarios were considered.

- Scenario A – Low-Water Use Development
- Scenario B – High-water Use Development
- Scenario C – Low-Water Use Development with Housing
- Scenario D – High-Water Use Development with Housing

All scenarios reflect the reuse of the existing 6,000 SF Administration Building. Scenario A also includes the development of the Marine Business District by businesses that are not water intensive. Scenario B reflects the development of the Marine Business District including a "wet user". Processing or aquaculture operations use more water than a typical business, but the exact amount is highly variable and depends on the application. For the purpose of this study, the proposed process was assumed to be 10,000 gpd. Scenarios C and D examine the demands in Scenarios A and B with the inclusion of fourteen three-bedroom housing units.

3.1 General Consumption Demand

General water demand is the combination of domestic, commercial, and industrial water used by consumers within the system. Table 3-1 below presents the anticipated demands for the scenarios described above.

Table 3-1: Demand Information

Scenario	Average Daily Demand (gpd)	Peak Hour Demand (gpm)*	Average Hourly Demand (gpm)
A	3,100	6.5	2.2
B	13,500	28.1	9.4
C	6,900	9.1	4.8
D	17,300	30.7	12.0

* Assumes demands at Administration Building and Marine Business District occur over an 8-hour workday

3.2 Fire Flow Demand

Fire flow requirements vary depending on building size, construction, layout, and use, and typically range from 500 gpm to 3,500 gpm. As the exact designs of the Marine Business District and housing development have not been chosen, we assumed values for the minimum fire flows in each area. These assumptions are listed in Table 3-2. The ISO recommended durations for the fire flows in each development area are also presented in Table 3-2.

Table 3-2: Fire Flow and Duration Recommendations

Area	Minimum Recommended Fire Flow (gpm)	Recommended Duration (hours)
Marine Business District	1,000	2
Housing Development	500	3

These assumptions were made with the understanding that the ability of the tank to provide these minimum recommended fire flows and durations would influence the Town's decision on whether or not to maintain the existing tank as a part of the water system.

4. SYSTEM CAPACITY

This section will examine the ability of the system, specifically the water tower, to provide enough water to meet general demand and fire flow requirements.

4.1 General Consumption Capacity

The existing water tower would serve two primary purposes within a water system at the Mitchell Field site. The tower would provide additional system pressure as well as equalization storage. This storage would allow the water system to meet the proposed peak hour demands of Scenario B and Scenario D, even though both demands are more than double the maximum withdrawal rate of the well. The need for additional system pressure and equalization storage for each scenario and the ability of the existing water tower to meet these needs is explored in the following sections.

4.1.1 System Pressure

Table 4-1 shows the available system pressure for each scenario's peak hour demand with the tank half full. These numbers factor in headloss associated with the pipe size indicated.

Table 4-1: Available System Pressure

Scenario	Location	Pipe Size (in)	System Pressure with Existing Water Tower (psi)	System Pressure without Existing Water Tower (psi)
A	Marine Business District	2	70	30
B	Marine Business District	3	68	28
C	Marine Business District	2	70	30
	Housing Development	2	38	0
D	Marine Business District	3	68	28
	Housing Development	2	38	0

Without the existing water tower, pumping would be necessary to maintain adequate system pressure at the Marine Business District. The housing development would likely need pumping with or without the existing water tower. It should be noted that while these smaller diameter water mains are adequately sized to carry peak hour demands with acceptable headloss, they do greatly reduce available fire flow. The system's fire flow capacity with the water tower is explained in Section 4.2.

4.1.2 Equalization Storage

While the well does have the capacity to meet the average daily demand for all four scenarios, the allowable withdrawal rate of 12 gpm is not large enough to meet the peak hour demands of Scenario B and Scenario D. Table 4-2 lists the storage necessary to meet the peak hour demand of each scenario. It should be noted that these peak hour demands are assumed to occur over an 8-hour workday.

Table 4-2: Required Storage

Scenario	Required Storage (gallons)
A	0
B	8,000
C	0
D	9,000

While the water system would need water storage to meet peak hour demands under Scenario B and Scenario D, the amount of storage needed is approximately 10% of the storage capacity of the existing water tower.

4.2 Fire Flow

Table 4-3 shows the available fire flow and duration at the Administration Building and Marine Business District based on the size of the pipe connecting the tank to the development area. The available fire flows are attainable while maintaining a pressure of 20 psi throughout the system and the duration was calculated assuming the tank is two-thirds full.

Table 4-3: Marine Business District Available Fire Flow

Pipe Size (Inches)	Available Fire Flow (gpm)	Duration (hours)
3	100	11.1
6	650	1.7
8	1,300	0.9
10	2,400	0.5
12	4,000	0.3

As this table illustrates, with the existing tank and groundwater conditions, it is not possible to provide the necessary flow and flow duration to satisfy ISO requirements, regardless of pipe size. The water storage tower is not sized to provide sufficient fire flow to future developments in the Marine Business District area.

Table 4-4 shows the available fire flow and duration at the proposed housing development based on the size of the 200-foot length of water main that would connect the water tower to the residential area. These fire flows are also attainable while maintaining a pressure of 20 psi throughout the system and the duration was calculated assuming the tank is 2/3 full.

Table 4-4: Housing Development Available Fire Flow

Pipe Size (Inches)	Available Fire Flow (gpm)	Duration (hours)
4	550	2.3
6	1,600	.8
8	3,500	.4

As Table 4-4 shows, a 4-inch pipe could supply 550 gpm of fire flow to the residential area for a period of 2.3 hours, just above the minimum recommended flow and duration of 500 gpm for 2 hours.

5. OPTIONS ANALYSIS

This section will examine the options available to the Town to provide water to the proposed Marine Business District and housing development. Detailed cost estimates of the first three options are presented in Appendix B. Pricing information detailed in the Preliminary Infrastructure Planning report by DeLuca-Hoffman Associates, Inc. dated May 2012 was used in the development of these estimates as the scope of the well improvements and treatment system construction remain largely the same.

Any option that involves keeping the water tower has a maintenance cost associated with it, but the cost varies greatly depending on whether or not the tank is brought into active service. If the tank is kept and brought into active service, the Town would be managing a public water utility, resulting in the highest maintenance cost. If the tank is maintained for a non-water related use, such as to hold cell phone antennas, the maintenance costs would be significantly lower.

5.1 Option 1: Bring the Water Tower into Active Service

Option 1 entails making improvements to the existing water tower in order for it to be filled with water and brought back into service. This option includes the following system improvements:

- Activate existing well;
- Construct treatment system for iron and manganese removal;
- Perform tank upgrades as described below;
- Install 3" HDPE pipe from water tower to Administration Building and Marine Business District; and
- Install 4" ductile iron pipe from water tower to housing development.

This option provides a reliable source of water and adequate system pressure, but would require a significant capital expense and on-going maintenance, specifically to the tower and treatment system, that is beyond the current capabilities of the existing Town staff and operating budget. This option does not provide adequate fire protection to the Marine Business District.

Recommended tank improvements under this option were derived from the USG report and include:

- Blast clean and recoat the interior and exterior of the tank;
- Repair and resurface existing tank foundations;
- Install gate and lock on exterior ladder;
- Replace or repair interior ladder
- Complete repairs on exterior ladder;
- Repair pitting and metal loss on the interior of the tank;
- Repair overflow pipe and install screen and flapper;
- Install roof hatch cover with lock; and
- Replace vent assembly.

These tank improvements would likely extend the tower's life by approximately 15 to 20 years. The estimated capital cost of this option is approximately $995,000.

5.2 Option 2: Maintain the Water Tower for Non-Water Related Uses and Pump Directly from the Existing Well

Option 2 involves making some structural improvements to the existing water tower in order for it to be used as a landmark or communications tower, but not as part of the water system. This option includes the following system improvements:

- Activate existing well;
- Construct treatment system for iron and manganese removal;
- Install pumps;
- Install ground storage tank;
- Install pressure vessels;
- Perform tank upgrades as described below;
- Install 3" HDPE pipe from new treatment building to Administration Building and Marine Business District; and
- Install 4" ductile iron pipe from new treatment building to housing development.

Similar to Option 1, this option also requires significant capital expense and maintenance to the treatment system and tank, and does not provide fire protection or adequate system pressure.

Recommended tank improvements under this option were derived from the USG report and include:

- Blast clean and recoat the exterior of the tank;
- Repair and resurface existing tank foundations;
- Install gate and lock on exterior ladder; and
- Complete repairs on exterior ladder.

These tank improvements would likely extend the tower's life by approximately 15 to 20 years before additional maintenance would be necessary. The estimated capital cost of this option is approximately $880,000.

5.3 Option 3: Demolish the Water Tower and Pump Directly from the Existing Well

Option 3 includes demolishing the existing water tower. This option would require the following improvements:

- Activate existing well;
- Construct treatment system for iron and manganese removal;
- Install pumps;
- Install ground storage tank;

- Install pressure vessels;
- Demolish water tower;
- Install 3" HDPE pipe from new treatment building to Administration Building and Marine Business District; and
- Install 4" ductile iron pipe from new treatment building to housing development.

Given the significant repairs that need to be completed in order to make the water tower to safe and stable, this option would reduce the capital cost of those initial improvements and eliminate future maintenance of the water tower. The estimated cost of this option is approximately $555,000.

5.4 Option 4: Drill a Well Near the Marine Business District

Option 4 includes drilling a new well in the vicinity of the Marine Business District and performing tank maintenance or demolition as described in Option 2 or Option 3. This option would reduce the amount of piping necessary to supply water to buildings within the Marine Business District, but the cost of locating and installing a new well with available water of adequate quantity and quality is unknown. Should the Town choose to construct the housing development as described in Scenarios C and D, a significant amount of piping would need to be installed to serve the proposed residential location.

The first step in locating a new groundwater supply on the site would be completing a desktop hydrogeotechnical study. This study involves analyzing existing sand and gravel aquifer maps to determine potential locations for a groundwater production well and then comparing those locations against known threats and areas of potential contamination. The cost of a desktop hydrogeotechnical study is approximately $10,000.

5.5 Option 5: Complete Initial Tank Repairs to Maintain the Integrity of the Structure

Option 5 includes the tank maintenance we would recommend completing in the near future to protect the structural integrity of the tank.

The foundations under the four tank support legs and the center riser are in need of repairs. Jim Sturgis, a Woodard & Curran structural engineer, completed a structural condition assessment of the tank's concrete foundations. His assessment is captured in a memorandum that is found in Appendix C of this report. The assessment concluded that the column leg pier foundations were in fair to poor condition while the center riser pipe foundation was in very poor condition. The assessment recommends conducting preliminary test pit exploration of the center riser pipe foundation, repairing the concrete for all five foundations, and demolishing the existing concrete block utility building at the base of the center riser pipe within the next six to twelve months. The estimated cost of these repairs is $47,000, which includes contingency and engineering costs and is broken down in greater detail in Appendix C.

At the request of the Town, we considered the possibility of removing the center riser pipe. The demolition of the center riser column would eliminate the potential connection of the tank to a future water system, making the tank suitable only for non-water related uses. After reaching out to tank manufacturers and Utility Service Group, the company that completed the tank condition assessment in 2014, we were unable to conclude whether the center riser pipe is designed to carry any structural loads. Should the Town decide to further explore this option, additional structural analysis would need to be completed on the tank, otherwise repair of the center riser pipe foundation as described in Appendix C will be required.

In addition to the foundation improvements, blast cleaning and recoating the exterior of the tank and repairing the existing foundations are recommended. Recoating the tank will help protect the structure from additional rust damage. We estimate the cost of recoating the tank to be $340,000 ($250,000 plus 35% for design, construction administration,

part-time inspection, and contingency) and we recommend recoating the tank within approximately 5 years. This cost includes measures for removing the existing lead paint. This estimate is intended for planning purposes only. A company that specializes in tank painting for water utilities should inspect the tank and provide a detailed quote prior to final budgeting for the work.

These costs are included in the estimates for Option 1 and Option 2, as these repairs would be necessary should the Town decide to maintain the tank for water or non-water related uses.

6. RECOMMENDATIONS

We recommend completing the improvements as described in Section 5.5 and in the structural assessment included in Appendix C. These improvements will maintain the structural stability of the tank while the Town determines the desired direction for the development of the Mitchell Field site. Additional costs related to the development of a future water system at Mitchell Field vary depending on the scope of the development as discussed in Section 5 of this report. As the Town gains greater clarity on the future of Mitchell Field, we will be happy to propose a scope for preliminary engineering services for the preferred option selected.

APPENDIX A: UTILITY SERVICE GROUP TANK CONDITION ASSESSMENT REPORT

Utility Service Group
Scott Kelley Water Systems Consultant
843 N. Barnstead Rd
Center Barnstead, NH 03225
603-724-8226
skelley@utilityservice.com

Mitchell Field Navy Facility Tank 100,000 Gallon Elevated Tank Condition Assessment Report

Town of Harpswell, ME

Prepared For:

Kristie Elaine
Town of Harpswell, ME

Assessment Performed July 1, 2014

TANK DATA

TANK NAME:	Mitchell Field Navy Tank				
TANK DESIGN:	Elevated	**CONSTRUCTION TYPE:**		Welded Steel	
LOCATION:	1410 Harpswell Neck Rd				
	CITY:	Harpswell		**STATE:**	ME
CAPACITY:	100,000 gallons	**HEIGHT:**	104’	**DIAMETER:**	28’
BUILDER:	Unknown	**YEAR:**	1950±	**CONTRACT #**	N/A
EXT. COATING:	Polyurethane	**LEAD:**	47,000 mg/kg	**CHROMIUM:**	290 mg/kg
INT. COATING:	Epoxy	**LEAD:**	180 mg/kg	**CHROMIUM:**	14 mg/kg
INSPECTOR(S):	MA Service Center		**DATE:**	July 1, 2014	

SUMMARY

Overall the tank is in good sanitary and structural condition with no immediate sanitary or structural repairs required. There are no significant deficiencies that could not be rectified if the tank were to be returned to active service.

The coatings on both the interior and exterior of the tank range from fair to poor condition depending on the location and exposure as noted below and further detailed in this report.

The exterior coatings are heavily weathered to the point the mid coat is exposed with additional degradation to the base metal and subsequent light to medium grade rust formation of the exposed substrate. The exterior coatings have tested positive for elevated lead and chromium levels therefore strict containment methodologies should be employed during any future maintenance programs.

The tank was not in service and was completely empty at the time of this inspection. The coatings on the underside of the interior roof are in only fair to poor condition with corrosion ranging from a light to heavy grade rust at least as viewed from the roof hatch. The shell coatings are in generally good condition with little visible degradation however there is evidence of extensive erection burrs and pitting throughout. The bowl surfaces are heavily stained from what appears to be minerals in the water supply and there are scattered areas of coating breakdown visible along the surfaces adjacent to the access ladder.

If this tank is to be returned to active service the following work should be performed.

EXTERIOR COATING RECOMMENDATIONS

If this tank is to be returned to active service the exterior should be schedule for complete maintenance prior to doing so. The exterior coatings have tested positive for lead (up to 47,000 mg/kg) therefore at such time as maintenance is performed it will be necessary to completely encapsulate the exterior in a Class 1A containment system as outlined in SSPC-Guide-6 (CON) to protect the surrounding neighborhood.

All exterior surfaces should be abrasive blast cleaned to an SSPS-SP#6 Commercial blast grade. The exterior surfaces should then be re-coated with a zinc/epoxy/urethane coating system. This coating system should be comprised of (1) coat of a moisture cured zinc rich

primer applied to a dry film thickness of 2.5 to 3.5 mils, (1) coat of a high-build catalyzed epoxy applied to a dry film thickness of 3.0 to 5.0 mils per and (2) top coats of a Aliphatic Polyurethane applied to a dry film thickness of 2.5 to 3.5 mils per coat.

INTERIOR COATING RECOMMENDATIONS

All interior surfaces of the roof, shell, bowl and riser should be abrasive blast cleaned in accordance with SSPC-SP #10 Near-White Metal standards followed by the application of (1) coat of NSF approved zinc rich urethane primer applied at 2.5 to 3.5 mils and (1) stripe coat of an NSF approved 100% solids epoxy applied to all seams from the high water level down, as well as to any heavily pitted surfaces which do not meet the criteria for spot welding repairs. All interior surfaces should then receive (1) full coat of an NSF approved 100% solids epoxy coating applied at 20.0 to 30.0 mils.

STRUCTURAL RECOMMENDATIONS

In order to restore the subject tank back to a sound structural condition, and ensure compliance with current state standards, the following items should be addressed.

1. There is one broken overflow pipe support bracket above the balcony level, and an additional severely deteriorated bracket at ground level which is exhibiting severe metal loss and is missing a retention nut that will require repairs when this tank is next maintained. In order to ensure the structural integrity of the pipe during future overflow events, the bracket at the balcony level should be repaired and welded back into place and the bracket at ground level should be replaced in its entirety.
2. The overflow pipe opening should be equipped with a screen and flapper assembly.
3. The roof hatch cover hinges were found to be in poor condition with one broken at the welded connection to the roof and the other severely bent and damaged. The cover was removed to ground level during this inspection but should be replaced if this tank is to be returned to active service.
4. Any pitting and/or metal loss representing a 35% or greater reduction in corresponding plate thickness on the interior shell and/or bowl should be spot and/or seal welded in such a manner so as to ensure 100% fusion with the parent metal and bring areas flush with the original plate surfaces. At this time it is estimated that less than (500) pits may require welding repairs.
5. The interior ladder connection points to the roof hatch should be reinforced with new metal to ensure the structural integrity is maintained.
6. The leg column concrete foundations are in poor condition with extensive cracking and general degradation taking place which should be repaired.
7. The riser foundation is in poor condition and should be resurfaced to prevent additional degradation.
8. There are several ladder cage straps that are severely bent from an unknown external force. At least one of the straps is no longer welded to the adjoining strap and therefore requires welding repairs to be performed.

SANITARY RECOMMENDATIONS

At such time as the subject is scheduled for rehabilitation consideration should be given to performing the following improvements and/or modifications.

1. Given the degree of existing corrosion and potential for metal fatigue currently taking place along the stub to roof junction and the outdated design of the vent itself, it is recommended that the vent assembly be replaced in its entirety with a new aluminum vacuum/pressure relief assembly with equal or greater airflow characteristics during the next tank maintenance operations.

SAFETY & SECURITY RECOMMENDATIONS

In order to enhance the safety and security of the subject tank the following items should be considered.

1. The shell is equipped with an open access ladder with no fall prevention system present. The leg column ladder is equipped with a cage but is also not equipped with a fall prevention system. A flexible cable fall prevention system should be installed to both the shell and leg column ladders.
2. In order to help prevent unauthorized access to the top of the tank consideration should be given to installing a hinged, lockable ladder gate that encloses the bottom 8' of the leg column ladder.
3. To improve the tank security the roof top access hatch should be equipped with locking hasps and locks.

WATER STORAGE TANK CONDITION ASSESSMENT REPORT

Utility Service Group
Merithew Service Center
128 Elm St Bridgewater MA 02324
508-279-9965 Fax: 508-279-9948

Date: 7/1/14	**Project:** 130564	**Task:** 1.01			
Tank Name: Mitchell Field Navy Facility					
Location: 1410 Harpwell Neck Rd	**City:** Harpswell	**State:** ME			
Capacity: 100,000 **gallons**	**Tank Type:** Elevated	**Construction:** Welded Steel			**Tank ID Plate:** No
HWL: 104'±	**LWL:** 80'±	**Diameter:** 28'	**Yr Built:** 1950	**By:**	**Contract:**

Exterior Roof Conditions: All questions are Yes / No / NA / NR unless listed (G/F/P) for Good / Fair / Poor / NA / NR

Tank Area	Item of Concern	Status	Comments
Roof Coating	Coating visual assessment? (G/F/P)	Fair	**Coating Type:** **Lead Bearing:** **DFT:** The roof coating is in only fair condition with heavy weathering and chalking noted throughout the majority of the roof plates which has exposed intact underlying intermediate paint. In addition there are isolated areas of top coat checking which has also resulted in the exposure of the intermediate coat and in some cases the bare steel substrate. Where the coating has degraded further there is evidence of light grade surface rust affecting an additional 10%-15% of the roof. Abrasion damage from the revolving roof ladder has resulted in medium grade rust where the base metal has been exposed.
	Actionable checking / delamination?	No	
	Actionable corrosion / deterioration?	Yes	
	Is there any graffiti paint or etchings?	No	
	Coating adhesion assessment? (G/F/P)	Fair	
	Does soiling impact visual appearance?	No	
	Will antenna equipment impact recoat?	NA	
Roof Structure	Structural visual assessment? (G/F/P)	Good	The roof appears in sound structural condition with no metal loss or significant deterioration noted. There is a 1"Ø open coupling in the roof adjacent to the access hatch that was originally used for cathodic wiring at one point in time. Remnants of wires remain but the opening is not sealed. The referenced wires should be removed and the coupling sealed if the tank is to be returned to service at any point in time.
	Are all plate seams sealed?	Yes	
	Significant pitting or metal loss visible?	No	
	Rigging holes / access ports sealed?	Yes	
	Other unsealed penetrations present?	Yes	
	Is the roof perimeter watertight?	Yes	
Roof Vent	Design meets state standards?	No	**Finial Stub OD:** 12" diameter The roof is equipped with a 27"Ø finial ball assembly that has an overall height of approximately 30", with a 13" tall x 12"Ø neck and six 9" x 4" oval vent openings in the ball. The 12" neck is open to the tank interior. All vent openings are equipped with screens however two of the screens are damaged with large holes present which allows for the possibility for birds and/or vermin to enter the tank through the open neck into the tank interior. At a minimum the screens should be repaired if this tank is to be returned to service however for long term serviceability consideration should be given to replacing the finial ball assembly with a new vacuum/pressure relief went assembly of equal or greater air flow capacity. The coatings on the exterior of the finial are in generally sound condition with only light to medium grade surface rust on the neck behind the revolving ladder bracket and general weathering on the remainder of the surfaces. The interior of the finial is in poor condition with light to medium grade rust on 100% of all surfaces visible through the openings in the vent screens.
	Screen intact?	No	
	Vacuum pallet functional?	NA	
	Unsealed penetrations present?	Yes	
Roof Access	At least two hatches to WC present?	No	The roof is equipped with one 24" x 24" hatch with an overlapping cover assembly which is in poor condition. One of the hatch cover hinges was bent and twisted and the welded connection point to the roof on the second was completely broken free making for an unsafe condition. The tank is not in use at this time therefore the damaged cover was removed and lowered to the ground to prevent accidental damage if the remaining hinge were to break off. The coatings on the exterior of manhole assembly are in fair condition similar the the adjacent roof however the coatings on the interior neck portion are in poor condition with medium to heavy grade surface rust on the entire raised neck.
	Primary meets state standards?	No	
	Additional meet state standards?	NA	
	All roof access points secured?	No	
	Antenna equipment affects roof entry?	NA	

Roof Safety	Is there a roof ladder / stair present?	Yes	The 2'2" wide revolving ladder with 4 sets of wheel assemblies spanning from the finial ball down to the balcony appears in sound structural condition. Scattered medium grade rust and areas of top coat delamination were observed on the side rails and ladder rungs consistant with that found on the roof surfaces with more significant medium to heavy grade rust noted on the revolving ladder wheel assemblies and associated mounting brackets. Overall the referenced corrosion and or coating deficiencies is affecting approximately 15 to 20% of the ladder surfaces. Two notches in the siderails cut to allow the ladder to follow the roof curvature should be welded.
	Is there a guardrail system present?	No	
	Required fall arrest system present?	No	
	Are the roof FAA lights operational?	No	

Exterior Shell, Bowl & Riser Conditions: All questions are Yes / No / NA / NR unless listed (G/F/P) for Good / Fair / Poor / NA / NR

Tank Area	Item of Concern	Status	Comments
Shell Coating	Coating visual assessment? (G/F/P)	Good	**Coating Type:** Polyurethane **Lead Bearing:** Yes **DFT:** NR The shell coating is in fair to poor condition with severe weathering throughout at least 50-60% of the surfaces. Light rust is breaking through the coatings on an additional 10% of the shell and there is more significant medium grade rust specifically where the coating has been damaged by the revolving ladder wheels. Sprayed graffiti on the shell is unsightly but does not appear to be affecting the integrity of the underlining coatings. The balcony and handrails appear intact and being adequately protected by the coatings except for medium to heavy rust and in some cases heavy rust scale buildup primarily where the walkway meets the supporting angle framework. Slight to moderate metal loss should be anticipated along the areas exhibiting rust scale buildup. Areas of light grade surface rust is also affecting an additional 10% of the top face of the balcony walkway and handrails. The coatings on the riser and bowl are in a similar condition as reported for the shell with extensive weathering noted throughout with scattered areas of light rust where the coating has failed to the substrate. Fair adhesion characteristics and the extent of weathering and corrosion noted above suggest the coatings would not be a good candidate for overcoating. The exterior shell and riser coatings were tested and found to contain 47,000 mg/kg lead and 290 mg/kg chromium and 690 mg/kg lead and 28 mg/kg chromium respectively. The high lead content dictates the need for a comprehensive Class 1 containment system as outlined in SSPC Guide 6 latest revision thereof to be employed during the exterior tank maintenance.
	Actionable checking / delamination?	No	
	Actionable corrosion / deterioration?	No	
	Logo visual assessment? (G/F/P)	NA	
	Is there any graffiti paint or etchings?	Yes	
	Coating adhesion assessment? (G/F/P)	Fair	
	Balcony visual assessment? (G/F/P)	Fair	
	Bowl coating assessment? (G/F/P)	Fair	
	Riser coating assessment? (G/F/P)	Fair	
	Does soiling impact visual appearance?	No	
	Will antenna equipment impact recoat?	No	
Shell Structure	Structural visual assessment? (G/F/P)	Good	It was reported that this tank is no longer being used and has been empty for a number of years. The exterior shell appears in good sanitary and structural condition with no evidence of leaks or other structural deficiences. There is evidence of numerous erection burrs remaining on the tank after the tank was constructed. These burrs have been flat topped in most instances and the coating remains generally sound but there is evidence of numerous burrs are sharp and were not ground smooth therefore when this tank is next maintained it is recommended that all sharp burrs be ground smooth and stripe coated with the new coating system being applied to ensure total coverage.
	Are all plate seams sealed?	Yes	
	Significant pitting or metal loss visible?	No	
	Unsealed penetrations present?	No	
	Riser base plate condition? (G/F/P)	Good	
	Any active leakage observed?	NA	
Riser Foundation	Structural visual assessment? (G/F/P)	Fair	The riser foundation is degrading with evidence of significant spalling of the top layer of concrete which has resulted in exposure of the underlying stone aggreggate. Concrete repairs should be performed if this tank is to be returmed to active service.
	Riser anchor bolts in sound condition?	Yes	
	Grout or sealer in sound condition?	Yes	
	Does grade promote good drainage?	Yes	
	Failure or undermining of foundation?	Yes	
Shell Access	At least two manholes present?	No	There are no shell manholes present.
	Primary meets state standards?	NA	
	Additional meet state standards?	NA	
	Structural damage / leakage visible?	NA	

Shell Safety	Balcony handrail meets standards?	No	**Balcony Handrail Hght:** 41.5" **Safety Climb Type:** NA The balcony handrail is 41.5" tall and the walkway is 23.5" wide with the entire assembly supported by steel angles and braces from underneath the balcony as shown in the attached photographs. Currently the balcony appears in sound structurally condition however water retention along the edges of the walkway to support angle has resulted in accelerated corrosive activity with associated heavy rust and scale buildup. The type and grade of rust scale suggests at least slight to moderate metal loss is occurring therefore welding repairs and/or sectional replacement may be required during future tank maintenance. Abrasive blast cleaning will be required before the extent of repairs will be fully known.
	Water retention on balcony walkway?	Yes	
	Required shell ladder present?	Yes	
	Required safety climb system present?	No	
	Is shell ladder equipped with a cage?	No	
	Are there rest platforms present?	No	
	Actionable corrosion / deterioration?	Yes	
	Crossover platform handrails sound?	NA	
	Do antennas / cables impact climbing?	NA	
Overflow	Extends to near ground level?	Yes	**Pipe OD:** 6"± The overflow system is comprised of an internal weir box and piping that exits the bottom of the box then transitions thru the roof knuckle to the exterior tank where it follows the tank shell and leg column down to ground level where it terminates in a 90° elbow approximately 20" above grade. The weir box is an atypical design with open narrow slots between the box and roof. The box is held in place by steel tabs welded to the box and roof plate as illustrated in the attached photographs. The interior protion of the weir box is inaccessible to properly apply a protective coating and therefore in poor condition with extensive corrosion present along the majority of the box interior. The exterior portion of the box and adjacent piping is in generally good condition except for light rust on the backside of the pipe as viewed from the roof hatch. The coatings on the exterior portions of the overflow pipe outside of the tank are in fair to poor condition with light grade surface rust along the majority of the backside of the pipe and the pipe brackets. There is also evidence of one broken pipe support bracket at the balcony level and an additional severely deteriorated bracket at ground level which is exhibiting severe metal loss and is missing a retention nut that will require repairs when this tank is next maintained. The pipe opening is not equipped with a screen or flapper assembly.
	External weir box sealed / secured?	NA	
	Actionable corrosion / deterioration?	Yes	
	Unsealed penetrations present?	No	
	Required air gap present?	Yes	
	Screen is intact or was replaced?	No	
	Flapper is functional or was replaced?	No	
	Drain, spillway or rip-rap present?	No	

Support Structure Conditions: All questions are Yes / No / NA / NR unless listed (G/F/P) for Good / Fair / Poor / NA / NR

Tank Area	Item of Concern	Status	Comments
Support Structure Coatings	Column / strut coatings? (G/F/P)	Fair	**Coating Type:** Not Tested **Lead Bearing:** NR **DFT:** The support structure coatings are in fair condition with little corrosive activity observed however there is severe weathering throughout the majority of all surfaces. Localized areas of light rust were observed on various turnbuckles, yokes and clevises and there are scattered areas of coating delamination at various interfaces of the struts. The total extent of corrosion does not appear to be affecting more that 10% of the support structure while at least 60% of the surfaces are exhibiting the referenced weathering.
	Actionable checking / delamination?	No	
	Actionable corrosion / deterioration?	No	
	Support rod conditions? (G/F/P)	Fair	
Support Structure	Column / strut visual condition? (G/F/P)	Fair	**Column Type:** Tubular The tank support structure, sway rods and struts all appear in sound condition with no significant corrosive activity affecting the structural integrity observed. There is a small ~3/4"Ø hole in the bottom of the leg column that supports the overflow pipe whose purpose in undetermined.
	Are sway / radial rods taught?	Yes	
	Sway / radial rod connections secure?	Yes	
Column Footings	Column shoe / base conditions? (G/F/P)	Fair	The column footings are showing evidence of cracking in the top layer of concrete however no significant spalling has occurred to date. If left in its current state additional cracking and subsequent degradation should be expected.
	Actionable corrosion / deterioration?	No	
	Failure or undermining of footings?	Yes	
	Grout or sealer in sound condition?	Yes	
	Does grade promote good drainage?	Yes	

Support Structure Safety	Actionable corrosion on column ladder?	No	**Safety Climb Type:** NA The leg column ladder appears in good condition however there are several bent cage straps and at least one strap that has broken free from it's point of attachment to an adjoining strap. The coatings on the leg column ladder and cage assembly are exhibiting heavy weathering throughout and scattered areas of light grade surface rust affecting 20% of the cage and up to 5% of the ladder.
	Required safety climb system present?	No	
	Is ladder equipped with cage / platform?	Yes	
	Functional security gate present?	No	
	Do antennas / cables impact climbing?	NA	

Interior Roof Conditions: All questions are Yes / No / NA / NR unless listed (G/F/P) for Good / Fair / Poor / NA / NR

Tank Area	Item of Concern	Status	Comments
Roof Coating	Coating visual assessment? (G/F/P)	Fair	**Coating Type:** Epoxy **Lead Bearing:** No **DFT:** The interior coating was tested for lead and chromium content with 180 mg/kg lead and 14 mg/kg chromium found in the submitted samples. The coatings on the underside of the roof and knuckle are in fair to poor condition with light rust throughout 15-20% of surfaces with additional areas of coating delamination down to the bare substrate exposing medium to heavy rust and affecting another 5-10% of the center roof area. Light to medium grade rust is also present under and adjacent to the four roof seam backing strips.
	Actionable blistering / delamination?	No	
	Actionable corrosion / deterioration?	No	
	Coating adhesion assessment? (G/F/P)	Fair	
	Rafter visual assessment? (G/F/P)	NA	
	Roof to shell junction? (G/F/P)	Good	
Roof Structure	Structural visual assessment? (G/F/P)	Good	The roof and knuckle plates appear to be in sound structural condition with no evidence of metal loss affecting the structural or sanitary condition of the tank. There is one open penetration in the roof for previously existing cathodic wiring assembly which should be sealed if this tank is to be returned to active service. There is a direct opening into the tank through the base of the finial ball to allow for venting of the tank interior however the vent screens are damaged allowing for a potential unsanitary condition and should be repaired/replaced. The underside of the roof is equipped with four backing strips where the four roof plate sub assemblies were field welded together during original construction of the tank. The remaining seams are butt welded along both the interior and exterior faces.
	Are all plate seams sealed?	Yes	
	Significant metal loss on plates visible?	No	
	Significant metal loss on rafters visible?	No	
	Roof bolted connections sound?	NA	
	Light leaks visible from the interior?	Yes	

Interior Shell & Bowl Conditions: All questions are Yes / No / NA / NR unless listed (G/F/P) for Good / Fair / Poor / NA / NR

Tank Area	Item of Concern	Status	Comments
Shell & Bowl Coatings	Coating visual assessment? (G/F/P)	Good	**Coating Type:** Epoxy **Lead Bearing:** No **DFT:** All observations were made from the roof hatch. The coatings on the interior shell are in good condition with no significant degradation observed. There is evidence of 300 or more old erection burrs present throughout the shell the majority of which appear to be well coated and protected by the coating system but several are exhibiting light to medium grade rust along sharp edges and/or voids in the paint. In addition there is evidence of extensive past pitting throughout the majority of the shell plates. As with the burrs, the pits appear to be adequately coated with little degradation observed. The pit depths could not be acurately determined due to a lack of access. The coatings on the bowl are heavily stained and there is evidence of at least three distinct areas of degradation along the lower bowl surfaces where the coatings appears to have become completely disbonded from the base metal with medium to heavy grade rust and possible slight to moderate metal loss occurring.
	Actionable blistering / delamination?	No	
	Actionable corrosion / deterioration?	No	
	Coating adhesion assessment? (G/F/P)	Good	
Shell & Bowl Structure	Structural visual assessment? (G/F/P)	Good	The interior shell and bowl appear in sound structural condition with no leakage or holes observed however there is evidence of extensive past pitting throughout the majority of the visible shell plates. As reported above, the shell plates were not accessible to measure the pit depths however they do not appear deep and for the most part adequately sealed by the current coating system. Interior bowl is equipped with a grate covering the top of the riser and there is a circulation line that passes thru the grate and a short distance into the bowl.
	Are all plate seams sealed?	Yes	
	Significant pitting or metal loss visible?	Yes	
	Bowl plate assessment? (G/F/P)	Good	
	Riser transition in sound condition?	Yes	
	Safety bars or grate present over riser?	Yes	

Shell Safety	Is an interior shell ladder present?	Yes	**Safety Climb Type:** NA The tank is equipped with a ladder spanning from the roof hatch to the bowl with only the top and bottom secured with no secondary lateral bracing present. The ladder was not used to gain access to the tank interior due to a concern that the interior ladder was not adequately welded at the upper connection point to the roof hatch neck thereby posing a potential safety hazard. All observations were made from the roof hatch. The coatings on the ladder are in fair condition with scattered areas of medium to heavy corrosion along the ladder rungs, rails, and where the ladder is welded to the roof hatch neck. When and/or if this tank is next maintained it will be necessary to reinforce the upper ladder connections to the hatch neck to ensure the structural integrity is maintained.
	Required safety climb system present?	No	
	Actionable corrosion / deterioration?	Yes	
	Internal balcony or platform present?	No	
Water Quality	Water quality visually acceptable?	NA	The tank was empty at the time of inspection. The interior is equipped with a floating cathodic protection system susbended from ropes attached to clips welded to the bottom shell ring. The cathodic wiring passes through a water tight fitting secured to a coupling welded in the bottom ring. The cathodic system appears intact but non functional.
	Significant staining or biofilm present?	NA	
	Significant floor sediment present?	No	
	Is there a mixing system present?	Yes	
	Is there a cathodics system present?	Yes	
	Is there a level indicator present?	No	

Interior Riser Conditions: All questions are Yes / No / NA / NR unless listed (G/F/P) for Good / Fair / Poor / NA / NR

Tank Area	Item of Concern	Status	Comments
Riser	Is the tank equipped with a dry riser?	No	**Riser OD:** The riser surfaces were not readily visible but appear in good condition as viewed from the roof hatch.
	Coating visual assessment? (G/F/P)	Fair	
	Actionable corrosion / deterioration?	No	
	Structural visual assessment? (G/F/P)	Good	
Riser Safety	Is an interior riser ladder present?	No	**Safety Climb Type:** The presence of a riser ladder could not be confirmed however none was visible from the roof hatch.
	Required safety climb system present?	NA	
	Actionable corrosion / deterioration?	NA	
	Is the riser equipped with a floor drain?	NR	

Site Conditions: All questions are Yes / No / NA / NR unless listed (G/F/P) for Good / Fair / Poor / NA / NR

Tank Area	Item of Concern	Status	Comments
Site	Is site equipped with a security fence?	Yes	The tank is surrounded by a locked perimeter fence that was found to be in good condition with no signs of damage. There are two buildings on site one of which is immediately adjacent to the riser and the 2nd is adjacent to a leg column. The building is open and appears abandoned. There are wires spanning from a penetration in the leg column to the building presumably from the cathodic system or from old antennae which are no longer on the tank.
	Any signs of damage to the fence?	No	
	Are fence gates secured with locks?	Yes	
	Is a vault or pump house present?	Yes	
	Sample tap onsite?	NR	
	Is there telemetry / SCADA onsite?	NR	
	Is there non-tank pooling water onsite?	No	
	Is there electrical service onsite?	Yes	

Eastern Analytical, Inc.

professional laboratory & drilling services

Regina Arthur
Utility Service Group
PO Box 1350
Perry , GA 31069-1330

ACCREDITED IN ACCORDANCE WITH nelac

Subject: Laboratory Report

Eastern Analytical, Inc. ID: 133267
Client Identification: Mitchell Field Navy Facility 100,000 Elevated | Town of Harpswell, ME
Date Received: 7/7/2014

Dear Ms. Arthur :

Enclosed please find the laboratory report for the above identified project. All analyses were performed in accordance with our QA/QC Program. Unless otherwise stated, holding times, preservation techniques, container types, and sample conditions adhered to EPA Protocol. Samples which were collected by Eastern Analytical, Inc. (EAI) were collected in accordance with approved EPA procedures. Eastern Analytical, Inc. certifies that the enclosed test results meet all requirements of NELAP and other applicable state certifications. Please refer to our website at www.eailabs.com for a copy of our NELAP certificate and accredited parameters.

The following standard abbreviations and conventions apply to all EAI reports:

Solid samples are reported on a dry weight basis, unless otherwise noted
< : "less than" followed by the reporting limit
> : "greater than" followed by the reporting limit
%R : % Recovery

Eastern Analytical Inc. maintains certification in the following states: Connecticut (PH-0492), Maine (NH005), Massachusetts (M-NH005), New Hampshire/NELAP (1012), Rhode Island (269) and Vermont (VT1012).

The following information is contained within this report: Sample Conditions summary, Analytical Results/Data, Quality Control data (if requested) and copies of the Chain of Custody. This report may not be reproduced except in full, without the the written approval of the laboratory.

If you have any questions regarding the results contained within, please feel free to directly contact me or the chemist(s) who performed the testing in question. Unless otherwise requested, we will dispose of the sample(s) 30 days from the sample receipt date.

We appreciate this opportunity to be of service and look forward to your continued patronage.

Sincerely,

Lorraine Olashaw, Lab Director | 7.11.14 Date | 3 # of pages (excluding cover letter)

SAMPLE CONDITIONS PAGE

EAI ID#: **133267**

Client: **Utility Service Group**

Client Designation: **Mitchell Field Navy Facility 100,000 Elevated | Town of Harpswell, ME**

Temperature upon receipt (°C): 24 **Received on ice or cold packs (Yes/No): N**

Acceptable temperature range (°C): 0-6

Lab ID	Sample ID	Date Received	Date Sampled	Sample Matrix	% Dry Weight	Exceptions/Comments (other than thermal preservation)
133267.01	AFM 130564 Interior	7/7/14	7/1/14	solid		Adheres to Sample Acceptance Policy
133267.02	AFM 130564 Exterior	7/7/14	7/1/14	solid		Adheres to Sample Acceptance Policy
133267.03	AFM 130564 Addt'l	7/7/14	7/1/14	solid		Adheres to Sample Acceptance Policy

Samples were properly preserved and the pH measured when applicable unless otherwise noted. Analysis of solids for pH, Flashpoint, Ignitibility, Paint Filter, Corrosivity, Conductivity and Specific Gravity are reported on an "as received" basis.
Immediate analyses, pH, Total Residual Chlorine, Dissolved Oxygen and Sulfite, performed at the laboratory were run outside of the recommended 15 minute hold time.
All results contained in this report relate only to the above listed samples.
References include:
1) EPA 600/4-79-020, 1983
2) Standard Methods for Examination of Water and Wastewater,20th Edition, 1998 and 22nd Edition, 2012
3) Test Methods for Evaluating Solid Waste SW 846 3rd Edition including updates IVA and IVB
4) Hach Water Analysis Handbook, 2nd edition, 1992

LABORATORY REPORT

EAI ID#: **133267**

Client: **Utility Service Group**

Client Designation: **Mitchell Field Navy Facility 100,000 Elevated | Town of Harpswell, ME**

Sample ID:	AFM 130564 Interior	AFM 130564 Exterior	AFM 130564 Addt'l	Analytical Matrix	Units	Date of Analysis	Method	Analyst
Lab Sample ID:	133267.01	133267.02	133267.03					
Matrix:	solid	solid	solid					
Date Sampled:	7/1/14	7/1/14	7/1/14					
Date Received:	7/7/14	7/7/14	7/7/14					
Chromium	**14**	**28**	**290**	SolAsRec	mg/kg	7/10/14	6010C	DS
Lead	**180**	**690**	**47000**	SolAsRec	mg/kg	7/10/14	6010C	DS

133267

Utility Service Group

CHAIN - OF - CUSTODY RECORD

TYPE SAMPLE: PAINT CHIPS (PAINT CHIPS, SPENT ABRASIVE, SOIL) STATE: ME

1. TANK INFO:	**Mitchell Field Navy Facility**	**100,000**	**Elevated**	**2. CUSTOMER / LOCATION:**	**Town of Harpswell, ME**
3. NAME OF SAMPLER:	**Amanda Maier/Scott Kelley**	**EMPLOYEE DEPT #:**	**119**	**4. SIGNATURE:**	**5. DATE:** 07/03/14
6. RETURN ADDRESS:	UTILITY SERVICE CO., INC. ATTN: REGINA ARTHUR / LARA ANDERSON P O BOX 1350 PERRY, GA 31069			**RETURN COPY OF THIS RECORD WITH RESULTS**	

7. SAMPLE NO.		8. SAMPLE REMOVAL DATA			9. ANALYSIS REQUESTED	
		DATE	TIME	SPECIFIC LOCATION	LEAD	OTHER (ARSENIC, CADMIUM, CHRONIUM)
AFM 130564	INTERIOR	07/01/14	9:00am	Roof	X	Chromium
AFM 130564	EXTERIOR	07/01/14	8:00am	Riser	X	Chromium
AFM 130564	ADDT'L	07/01/14	8:10am	Exterior Shell	X	Chromium

10. SAMPLES RELINQUISHED BY:			11. SAMPLES RECEIVED BY:		
NAME	Date	Time	NAME	DATE	TIME
Amanda Maier/Scott Kelley	07/03/14	10:52 AM			
USPS	7/07/14	10:15			

UTILITY SERVICE COMPANY INC.
WATER TANK MAINTENANCE

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laraanderson@utilityservice.com LARA ANDERSON (478) 988-5274
skelley@utilityservice.com FAX: (478) 987-2991

Invoices to: accountspayable@utilityservice.com

24.0°C noon

Mitchell Field Navy Tank Harpswell, ME
Inspected on 7/1/14

Overall view of the 100KG Mitchell Field elevated tank.

Roof finial ball has six 9"x4" oval vent screens, two of which have large holes.

Showing a hole in the finial ball screen.

Showing a hole in the finial ball screen that should be repaired if the tank is to be returned to service.

Showing corrosion on the interior of the finial ball which is open to the tank interior

The finial ball neck appears to be in good condition

The hinges on the single 24"x24" hatch cover are broken

Showing one of two broken hatch hinges.

The second hinge is bent and twisted

Showing a lock hasp present on the hatch neck but there was no lock

The hatch cover was removed for safety reasons due to poor structural integrity of the hinges

Extensive corrosion on the hatch neck does not appear to be affecting the structural integrity at this time

Mitchell Field Navy Tank Harpswell, ME
Inspected on 7/1/14

The revolving roof ladder connection bracket to the finial ball neck appears in sound condition but there is corrosion on the neck surfaces

Roof revolving ladder appears in sound structural condition.

Showing corrosion of the roof ladder side rails.

Showing extensive corrosion on the ladder rungs and rails.

Shows medium garde corrosion on the underside of the ladder and wheel assembly.

The coatings on the revolving ladder are delaminating at the prime coat

Shows medium grade corrosion where the coating has delaminated from the roof ladder siderails

Showing a notch in the roof ladder side rail to allow for proper fit to curvature of the roof

Showing a notch in the roof ladder side rail to allow for proper fit to curvature of the roof

Shows abrasion damge on shell coating from the revolving ladder

The exterior roof is in fair to poor condition with heavy weathering revealing the underlying coatings.

Roof appears in sound structural condition with only light rust and weathering noted.

Light rust and severe weathering was observed throughout the roof plates

Shows evidence the top coat is chalked and degraded

Showing weathering and abrasion damage along the center roof area

Showing abrasion damage around the center dollar plate due to the roof ladder wheels

Shows light rust breaking through the coatings on the roof

There is an open hole in the roof for wiring that should be sealed if the tank is returned to service

Shows adhesion testing on roof surfaces indicating generally sound interfacial adhesion

Shows adhesion testing on roof surfaces indicating generally fair interfacial adhesion

The coatings on the roof knuckle are weathered and there is evidence of abrasion damage from the revolving ladder

Showing abrasion damage from the rotating roof ladder.

Overall view of the coatings on the roof knuckle and shell exhibiting significant weathering and areas of light rust

There are no open or unsealed penetrations in the shell plates to affect the sanitary condition of the tank

Shows light rust and soiling present on the shell plates

Showing top coat weathering along the upper shell surfaces

Showing top coat weathering on the shell and leg column post heads

Shows what appears to be erection burrs adjacent to the shell plate weld seams

Showing graffiti on the exterior shell.

Showing light rust and weathering on the exterior shell

Showing wiring protruding from a pipe stub in the leg column post head at the balcony level

Showing corrosion on a cover plate installed to one of the leg column post heads

Showing a junction box and associated conduit for cathodic wiring at the balcony level.

Showing heavy corrosion with possible metal loss at the shell to balcony junction

The balcony walkway are in generally good condition except for heavy corrosion along the edges.

There is heavy corrosion and slight to moderate metal loss at the balcony to shell angle junction

Showing a gap at the shell to balcony junction with heavy rust on the shell plate

Shows evidence of heavy rust and scale with slight to moderate metal loss of associated surfaces

Shows scattered areas of coating failure and corrosion on the handrails.

The balcony handrails are in good structural condition although there is scattered areas of degradation

Shows a davit assembly secured to the balcony handrail

Shows an area of significant light to medium grade rust on the balcony handrail

Shows an area of significant light to medium grade rust on the balcony walkway

Showing corrosion along the bolts and edges where a leg column attaches to the balcony.

Showing corrosion along the underside of the balcony walkway at the junction with what appears to be a supporting angle

Showing corrosion and at least slight to moderate metal loss along the underside of the balcony.

The coatings on the visible balcony support braces appear in sound condition

Shows a pass through in the balcony handrail which allows for access onto the balcony

The leg column access ladder appears in sound structural condition with no obvious deficiencies observed

The coatings on the ladder safety cage are in only fair to poor condition

Several of the vertical ribs of the ladder cage are bent which has compromised the welds at several locations

Showing corrosion on one of the cage connections to the ladder

Light rust on the weld seams of several ladder to leg column brackets does not appear to be affecting the structural integrity

The leg column access ladder terminates at ground level and there is no security gate to prevent unauthorized access

The bowl surfaces visible from the access ladder are weathered but exhibit little corrosion

Shows significant weathered coating on the bowl surfaces

Shows significant weathered coating and scattered areas of light rust on the bowl surfaces

The riser to bowl junction appears in sound structural condition with no obvious deficiencies observed

Shows an overall view of the riser and associated radial rods

Shows rust on a riser radial rod with no evidence of any structural issues

Shows areas of weathered coating on the riser

Corrosion is present on all bolted connections as well as where the tank ID plate was originally attached

The riser foundation is in poor condition with significant degradation of the concrete exposing large aggreggate

Shows the base of the riser adjacent to a concrete block building

Shows concrete rubble from the degraded riser foundation

There is an unused penetration in the side of the riser adjacent to the hatch

The coatings on the leg columns are weathered but exhibit little corrosion

Shows significant weathering on the leg columns

Shows the sway rod and strut connections to the leg columns to be in good condition

The sway rod turnbuckles are experiencing light rust but appear in good structural condition.

Showing rust on the interior of a sway rod yoke and coating delamination and surface corrosion on the adjacent strut

Showing localized areas of light rust on various connections to the support structure

The sway rod connections appear structurally sound but are exhibiting light rust on the threads

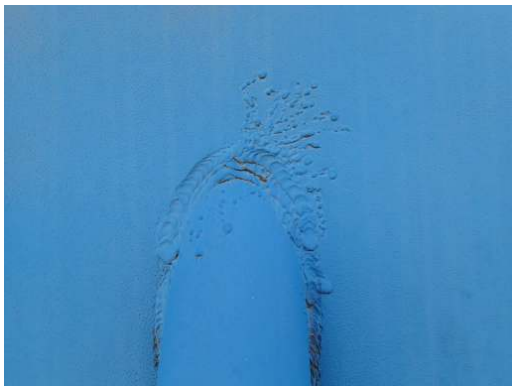
Shows the coatings on the leg columns to be weathered but there is little corrosion

The leg column base plates appear in sound structural condition with no significant coating degradation observed

Shows what appears to be surface cracking in one of the leg column footings

Shows an old cathodic protection control center attached to the base of the leg column

There is an ~3/4"Ø hole in the base of the leg column that supports the overflow pipe



Showing rough weld and spatter where the overflow pipe attaches to the shell.

Showing corrosion on the underside of the overflow pipe and adjacent shell surfaces.

The coatings on the overflow pipe bracket above the balcony is in poor condition and there is evidence of a cracked weld

Showing a crack on the overflow pipe standoff bracket at the balcony level

Showing corrosion on the backside of the overflow pipe as viewed from the balcony

Showing where the overflow pipe penetrates the balcony.

The overflow pipe is supported at multiple levels on the leg column

Showing corrosion occuring on the backside of the overflow pipe.

The overflow pipe coatings are in fair condition with scatterd areas of corrosion mostly along the backside of the pipe

Shows heavy rust, scale and associated moderate metal loss as well as a missing nut on the lower overflow bracket

The overflow terminates approximately 20"± from grade with no evidence of a splash pad or riprap area for drainage

The overflow pipe is not equipped with a screen or flapper assembly

Shows a concrete block wall building under the tank and adjacent to the riser pipe

Shows wiring spanning from a wood framed building to an adjacent leg column

Shows a wood building adjacent to the tank

The building appears to be run down and no longer in use and there is significant vegetation growth nearby

The perimeter fence surrounding the tank site appears in sound condition

Mitchell Field Navy Tank Harpswell, ME
Inspected on 7/1/14

There is a heavy growth of trees/shrubs and grass both inside and outside of the perimeter fence

Shows large tree/shrub present under the tank

Shows the perimeter fence and access gate surrounding the tank site

View of the closed access gate upon completion of the inspection

The access gate is equipped with a lock.

Shows the close proximity of an access road and building to the tank

Overall view of the area as viewed from the top of the tank

Overall view of the area as viewed from the top of the tank

Overall view of the area as viewed from the top of the tank

Interior roof coatings are in only fair to poor condition with areas of complete delamination to the substrate and associated medium to heavy rust as well as scattered areas

Delamination was noted along the center roof as seen near the vent opening.

Showing delamination along the roof plates and seams.

Showing delamination and corrosion along the roof plates and seams.

Showing light rust breaking thru the coatings on the underside of the roof plates.

Shows backing strip in place on the underside of theroof and knuckle plates

Showing light rust on the erection burrs remaining on the knuckle and shell plates

Shows corrosion under the backing straps along the roof and knuckle plates

Showing delamination along the upper roof plates and seams with additional light rust present on the lower surfaces

The roof appears in sound condition with no metal loss or open penetrations noted.

Showing an adhesion test performed on the underside of the roof indicating generally good adhesion

Sideview of the weir box configuration showing the box is stepped off of the roof and supported by gusset plates only with no access for painting

Interior view of the weir box showing corrosion along inaccessible surfaces

Corrosion is occuring on the internal portion of the overflow pipe.

Corrosion is occuring on the internal portion of the overflow pipe.

The shell coatings are in good condition and past pitting appears to be well sealed by the coating

Shows past pitting on the upper shell ring which is being afforded good protection by the existing coating system

Shows no significant coating degradation occurring on the interior shell

Showing rigging points for the cathodic protection system on the interior shell.

Showing cathodic equipment on the interior shell.

The interior bowl is stained and there appears to be three separate areas of degradation. The cathodic protection system appears intact.

Showing an area of coating delamination and corrosion on the interior bowl.

Showing delamination of the coatings on the bowl surface at the base of the interior ladder.

View of the floating cathodic system.

The top of the riser is equipped with a grate thru which a circulation line penetrates

The riser grate and circulation line appear intact

The weld integrity at the top of the interior ladder is questionable and should be reinforced

The interior ladder siderails connections to the manhole neck should be extended and reinforced during future maintenance

Showing corrosion on the backside of the interior ladder siderails adjacent to the roof.

The interior ladder appears in sound structural sound condition but there is significant corrosion along the rungs and rails. There are no mid point stabilizers.

Closeup of corrosion on the interior ladder.

Closeup of corrosion and past metal loss on the interior ladder.

APPENDIX B: COST ESTIMATE

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Option 1: Bring the Water Tower into Active Service					
No.	Description	Unit	Estimated Quantity	Unit Price	Value
1	**Well Improvements**				
	Well Approval & Initial Monitoring*	LS	1	$10,000	$10,000
	Pump & Piping Modifications	LS	1	$20,000	$20,000
	Electrical Upgrades	LS	1	$15,000	$15,000
2	**Treatment System***				
	Metals Pre-Treatment	LS	1	$15,000	$15,000
	Infrastructure	LS	1	$70,000	$70,000
3	**Tank Improvements****	LS	1	$400,000	$400,000
4	**Marine Business District Water Main Installation**				
	3" HDPE Pipe	LF	3500	$50	$175,000
	Valves	EA	3	$1,000	$3,000
	Pavement Repair	SY	100	$50	$5,000
5	**Housing Development Water Main Installation**				
	Housing Development (4")	LF	200	$100	$20,000
	Valves	EA	2	$1,000	$2,000
	Pavement Repair	SY	10	$50	$500
	TOTAL CONSTRUCTION SUBTOTAL				**$736,000**
				Design, Construction Administration, Part-Time Inspection, and Contingency (35%)	**$258,000**
				Total Project Cost	**$994,000**

* Estimated costs for the well improvements and treatment system were based on the Preliminary Opinion of Probable Cost presented in Table 3-1 of the Preliminary Infrastructure Planning report prepared by DeLuca-Hoffman Associates, Inc. in 2012. A 10% increase was included to account for inflation.

** The estimated cost of tank improvements was based on information presented in Section 3.1.2 of the Preliminary Infrastructure Planning report prepared by DeLuca-Hoffman Associates, Inc. in 2012. A 15% increase was included to account for inflation and additional deterioration.

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Option 2: Maintain the Water Tower for Non-Water Related Uses and Pump Directly from the Existing Well					
No.	Description	Unit	Estimated Quantity	Unit Price	Value
1	**Well Improvements**				
	Well Approval & Initial Monitoring*	LS	1	$10,000	$10,000
	Pump & Piping Modifications	LS	1	$20,000	$20,000
	Electrical Upgrades	LS	1	$15,000	$15,000
2	**Treatment System***				
	Metals Pre-Treatment	LS	1	$15,000	$15,000
	Storage Tank	LS	1	$8,000	$8,000
	Infrastructure and Pressure Vessels	LS	1	$90,000	$90,000
3	**Tank Improvements****	LS	1	$285,000	$285,000
4	**Marine Business District Water Main Installation**				
	3" HDPE Pipe	LF	3500	$50	$175,000
	Valves	EA	3	$1,000	$3,000
	Pavement Repair	SY	100	$50	$5,000
5	**Housing Development Water Main Installation**				
	Housing Development (4")	LF	200	$100	$20,000
	Valves	EA	2	$1,000	$2,000
	Pavement Repair	SY	10	$50	$500
	TOTAL CONSTRUCTION SUBTOTAL				**$649,000**
				Design, Construction Administration, Part-Time Inspection, and Contingency (35%)	**$228,000**
				Total Project Cost	**$877,000**

* Estimated costs for the well improvements and treatment system were based on the Preliminary Opinion of Probable Cost presented in Table 3-1 of the Preliminary Infrastructure Planning report prepared by DeLuca-Hoffman Associates, Inc. in 2012. A 10% increase was included to account for inflation.

** The estimated cost of tank improvements was based on information presented in Section 3.1.2 of the Preliminary Infrastructure Planning report prepared by DeLuca-Hoffman Associates, Inc. in 2012. A 15% increase was included to account for inflation and additional deterioration.

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Option 3: Demolish the Water Tower and Pump Directly from the Existing Well					
No.	Description	Unit	Estimated Quantity	Unit Price	Value
1	**Well Improvements**				
	Well Approval & Initial Monitoring*	LS	1	$10,000	$10,000
	Pump & Piping Modifications	LS	1	$20,000	$20,000
	Electrical Upgrades	LS	1	$15,000	$15,000
2	**Treatment System***				
	Metals Pre-Treatment	LS	1	$15,000	$15,000
	Storage Tank	LS	1	$8,000	$8,000
	Infrastructure and Pressure Vessels	LS	1	$90,000	$90,000
3	**Tank Demolition****	LS	1	$45,000	$45,000
4	**Marine Business District Water Main Installation**				
	3" HDPE Pipe	LF	3500	$50	$175,000
	Valves	EA	3	$1,000	$3,000
	Pavement Repair	SY	100	$50	$5,000
5	**Housing Development Water Main Installation**				
	Housing Development (4")	LF	200	$100	$20,000
	Valves	EA	2	$1,000	$2,000
	Pavement Repair	SY	10	$50	$500
	TOTAL CONSTRUCTION SUBTOTAL				$409,000
				Design, Construction Administration, Part-Time Inspection, and Contingency (35%)	**$144,000**
				Total Project Cost	**$553,000**

* Estimated costs for the well improvements and treatment system were based on the Preliminary Opinion of Probable Cost presented in Table 3-1 of the Preliminary Infrastructure Planning report prepared by DeLuca-Hoffman Associates, Inc. in 2012. A 10% increase was included to account for inflation.

** The estimated cost of tank demolition was based on information presented in Section 3.1.2 of the Preliminary Infrastructure Planning report prepared by DeLuca-Hoffman Associates, Inc. in 2012. A 10% increase was included to account for inflation.

APPENDIX C: STRUCTURAL CONDITION ASSESSMENT OF CONCRETE FOUNDATIONS

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MEMORANDUM

TO: Marguerite Kelly, Treasurer, Town of Harpswell

FROM: Jim Sturgis PE, Senior Structural Engineer / Principal, Woodard & Curran

DATE: March 6, 2017

RE: Town of Harpswell, Maine – Mitchell Field Water Tower
Structural Condition Assessment of Concrete Foundations

Introduction

Woodard & Curran was asked by the Town of Harpswell (Town) to perform a limited structural condition assessment of the concrete foundations supporting the Mitchell Field Water Tower (Tower). The Town has observed various degrees of cracking, spalling, and deterioration relative to these foundations. The purpose of this assessment was to evaluate their structural integrity and provide the Town with guidance on the need for repairs and further evaluation, as appropriate. This Memo will provide a description of the Existing Construction, Observations with photos, Recommendations, and Conclusions along with an opinion of construction cost. The scope of this condition assessment is limited to the concrete foundations and does not include the Tower superstructure, nor does it include any structural analysis or calculations to evaluate the code compliance or confirm the overall stability of the Tower.

The assessment was performed on February 23, 2017 by Jim Sturgis, PE, Woodard & Curran Sr. Structural Engineer. He was met on site by Donnette Goodenow and Dave Chipman of the Town's Water Tower Task Force, both of whom provided background on the Tower. Woodard & Curran also arranged to have repair contractor Bill Roy of Knowles Industrial Services Corporation (Knowles) on site to observe the Tower foundations. After the site visit, the Town provided original construction drawings for the Tower dated 1952, so it is assumed that the Tower was constructed around that time. These drawings are clearly not record drawings, as the center riser pipe foundation appears to be much different than that shown on these drawings.

Existing Construction

The Tower is approximately 104' high with an elevated, 100,000-gallon, welded steel tank supported by four column legs (columns) approximately 22" in diameter. There is also a center riser pipe with a diameter of approximately 48" (+/-), which appears to be the carrier pipe for a smaller-diameter water line. The columns have three braced bays over their full height with 8" horizontal steel struts and steel rod X-bracing on all sides in each bay. All steel superstructure is painted steel, and was reportedly last repainted in the early 1980's.

Each column is supported on a concrete foundation pier (pier), which is trapezoidal in shape. Each tapered pier is approximately 3'-6" square on top with a large chamfered edge, 7'-9" square on bottom, and projects 12" above grade. Original drawings show each pier bearing on a 9'-3"-square x 12" thick footing, with the bottom of footing shown at 5'-0" below grade. The footing is shown as unreinforced, while the pier is lightly reinforced with four #9 bars (1 1/8" diameter) located in each corner and extending into the footing. Each column has a circular 1 1/4"-thick base plate on 1" of leveling grout. See Photos 1 & 2 below:

Photo 1 – Water Tower

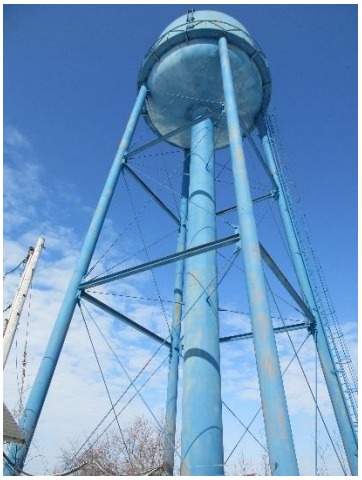

Photo 2 – Water Tower Close-Up

Riser Pipe Foundation per the Original Drawings: The original drawings show a large concrete vault below the riser pipe with exterior dimensions of 7'-6" square x 7'-9" high on an 18"-thick concrete footing. The vault has reinforcing shown on all areas (18" base slab, 9" walls, and 18" cover slab at grade). The riser is shown as 12" diameter. The drawings do not show the concrete block utility building adjacent to the riser pipe.

Riser Pipe Foundation Actual Conditions: The actual conditions of the riser foundation appear to be much different than that shown on the drawings. The only thing visible at grade is a heavily-deteriorated concrete encasement slab around the much larger (48" diameter +/-) riser carrier pipe; there is no sign of a vault nor access to a vault below. It is possible that a construction change was made to delete the vault in favor of solid concrete encasement around the larger pipe. Also, a concrete block utility building was constructed in contact with the riser pipe. The existing slab appears to be approximately 6'-10" square of unknown thickness, and projects a few inches above grade; the east side of the slab is built into the adjacent concrete block building wall. Based on field observations, it is unknown what concrete construction exists below grade and whether there is a vault or just solid encasement. It is also not known how the riser pipe is supported (concrete vault, concrete encasement on soil, etc.). This could be confirmed before or during slab demolition and repair, as described in the Recommendations section.

The concrete block utility building is approximately 16'-8" x 10'-0" x 9'-4" high with a concrete foundation and concrete slab roof that slopes to drain along the south end. The building's west wall is built into the side of the riser pipe, providing protected access to the pipe. The building houses an electrical panel, electrical conduit, lighting, a riser sampling line, and a riser blind flange. The building has one wooden door, two wooden windows, and one mechanical louver. The Town reported that there was once a boiler inside the building that provided heat to the tank to prevent freezing during the winter months.

Observations

In general, the pier foundations were found to be in fair to poor condition, while the riser foundation was observed to be in very poor condition. The steel Tower superstructure was not inspected as part of this scope, but appears to be in fair condition. The concrete block utility building was found to be in poor condition. Each foundation's structural integrity was assessed using visual inspection and nondestructive hammer sounding to determine the presence of hollow, delaminated, or otherwise unsound concrete. Further detailed descriptions and photos of each area are included below:

1. Column Leg Pier Foundations: The concrete piers were found to be in fair to poor condition. Each pier had varying degrees of surface defects on the top and exposed sides of the pier, including spider cracking (or "crazing"), hollow concrete, spalling, and evidence of moisture penetration through surface cracks (white staining or "efflorescence"). Approximate estimates of the percentages of hollow concrete for each pier are as follows: Southwest (SW) Pier – 75%; SE Pier – 50%; NW Pier – 25%; NE Pier – 50%. Minor spalling was observed on the corners of the SW & NE piers. Conditions of below-grade portions are unknown. It appears that the concrete was originally coated, but only small portions of the blue coating are still intact. The painted steel column legs and anchor bolts are in fair condition with no major signs of corrosion or structural weakness; the paint is worn and faded, but the lower portions exhibit only minor levels of surface corrosion.

Photo 3 – SE Foundation Pier

Photo 4 – SW Foundation Pier

Photo 5 – NE Foundation Pier

Photo 6 – NW Foundation Pier

2. Center Riser Foundation: The concrete surrounding the riser pipe is very poor condition with extensive deterioration, erosion, and spalling, which has resulted in several inches of material loss in many areas. The concrete that remains is very weak, unstable, porous, and unsound, indicating that much or possibly all of it will need to be replaced. As discussed in the Existing Construction section above, the configuration of the concrete below grade is unknown. The concrete slab extends into the concrete block wall of the adjacent utility building, so any demolition and repair of this foundation will affect and need to be coordinated closely with the building should it remain. The painted steel riser pipe and anchor bolts are in fair condition with no major signs of corrosion or structural weakness.

Photo 7 – Riser Foundation SW Corner

Photo 8 – Riser Foundation NE Corner

3. Concrete Block Utility Building: This building is in poor condition. The sloped cast-in-place concrete roof slab has major deterioration on its edges, evidence of cracks with moisture damage on the underside of the slab and perimeter concrete, and has likely endured many years of moisture penetration through the roof. The concrete block walls show signs of deterioration and moisture damage. The wood doors and windows are in very poor condition, while the floor slab is in fair condition. Though out of the scope of this assessment, it is also assumed that the electrical panel and wiring is in need of updating.

Photo 9 – Utility Building Exterior

Photo 10 – Utility Building Interior

Recommendations

Given that this structure is over 60 years old, there are portions of it that are in fair condition (steel Tower superstructure), fair to poor condition (concrete column piers), poor condition (concrete block building), and very poor condition (center riser foundation). Though the steel Tower was not part of our scope, it does appear to be in sound condition and its structural integrity intact. The column piers need repair, but appear to be structurally sound. The riser foundation is very unsound and is structurally compromised, and needs partial or full replacement. It is recommended that the below recommendations be implemented in the next 6 to 12 months to refurbish the foundations and ensure that structural conditions do not worsen. The tank and riser pipes should be empty and off-line during performance of this repair work. Detailed recommendations are as follows:

1. Preliminary Test Pit Exploration of Riser Foundation: The below-ground configuration of the riser foundation is unknown and there appear to be major discrepancies with what is shown on the original

construction drawings and the actual conditions. We recommend that a repair contractor be retained to do some preliminary exploration, under the supervision of a structural engineer. This would involve digging a test pit along the side of the concrete slab (assume 4' deep) to determine the depth of the concrete encasement and to also observe the condition of the concrete below grade to be compared with the above grade condition (very poor). It is assumed that excavation would be provided by the Town's Public Works crew. In addition, it is recommended that a minimum of three test holes be drilled through the slab around the riser base plate to identify the slab depth and what exists below (soil, vault space, or solid concrete). Since the original drawings are not accurate, this field exploration will enable us to make more sound decisions on how best to repair these foundations and better understand the related cost implications. It will also give us better insight as to the structural integrity of the existing riser pipe support.

2. Column Leg Pier Foundations: The extensive cracking in these foundations makes them susceptible to future moisture penetration and damage, with some evidence that this has already been occurring for many years to varying degrees. All areas that are cracked, hollow, spalled, or otherwise unsound shall be chipped down to a depth as required to achieve a sound, durable concrete substrate. It is anticipated that the perimeter of the piers should be dug down approximately 12" to expose the foundation and inspect condition. Once the unsound areas are delineated, the perimeter of all repair areas shall be saw-cut to a depth of 1". All areas inside each repair area shall be chipped out to a uniform depth of no less than 1", but deeper for areas where necessary to find sound concrete. If reinforcing is encountered during demolition, it will be inspected, cleaned, and coated with an anti-corrosion bonding agent. Any repair areas deeper than 2" shall be reinforced with nominal steel reinforcing (#4 @ 12" on center) to mechanically bond new concrete to existing concrete. Sides shall be formed with plywood to match existing pier wall geometry, including the edge chamfers. Epoxy bonding compound should be applied to all existing concrete substrates to enhance bond. New high-performance repair mortar shall be installed to restore lost concrete as required to match the pier's original geometry. After proper curing is complete (minimum of 7 days), it is recommended that all exposed-to-view concrete be coated with an elastomeric polyurethane coating to provide added moisture protection to the concrete. The painted steel superstructure should be prepared and repainted in the next 3-5 years.

3. Center Riser Foundation: Before the riser foundation is repaired, the adjacent utility building should be demolished (see Item 4 below). The results of the Preliminary Test Pit Exploration recommendations outlined in Item #1 will be used as a basis for developing the repair strategy for this foundation. However, it is assumed that the concrete slab around the riser will be demolished for a depth of at least 12" and to a point close to the riser base plate perimeter. Any existing rebar will be left in place during concrete demolition, its condition inspected, and salvaged for re-use (or replaced in kind if compromised). Once sound concrete is achieved below, or the bottom limits of the slab thickness are exposed, edge forms will be installed and new 4000 psi concrete will be placed to match the original slab geometry. Please note that both design recommendations and pricing of this portion of the work is dependent upon the results of Recommendation #1. Furthermore, even after this exploration there may be some unexpected conditions encountered during construction that may require additional work and expense. The painted steel superstructure should be prepared and repainted in the next 3-5 years.

4. Concrete Block Utility Building: This concrete block building is in poor condition and should be demolished in its entirety down to the concrete foundation (which can remain). Other utilities, such as electrical, shall be demolished or upgraded (by an electrical contractor) for an exterior exposure if necessary, unless the building is to be replaced. Note that if this building is not demolished, it will complicate the center riser foundation repairs since that slab is integral to the west building wall.

Conclusions

It is recommended that the above repair items be implemented within the 6 to 12 months to extend the life of the structure, to prevent the current deterioration issues from worsening, and to maintain the overall structural stability of the Tower. The painted steel Tower superstructure should be prepared and painted within the next 3 to 5 years; the coating approach will depend on whether it will be used for water storage or just restored as a landmark.

Repair work such as this requires a highly-skilled, specialty contractor with successful experience performing similar work. When the Owner opts to select a low bid Contractor utilizing an open bid process for this type of specialty repair work, it has been our experience that the quality of work that Owners receive from Contractors can be unpredictable. Our recommendation is that the Town consider contracting directly with Knowles Industrial Services Corporation out of Gorham, Maine. Knowles has a strong reputable for this type of repair work and we have worked with them on numerous projects over the years. It has been our experience that they provide high quality work at a fair price. As stated previously, Knowles has visited the site already to inspect the Tower and they are confident they can remedy the current situation. Upon request, we can provide the Town with several recent references of clients who used Woodard & Curran and Knowles to make similar corrective repairs as part of their projects.

Extended warranties (3 years) can be offered from Knowles to provide the Town with more protection and peace of mind. In our experience over the years, Knowles has also shown a willingness to stand behind their work. If multiple bidders are required, we recommend that a select bid list of no more than three bidders be utilized; however, please recognize that this option would require Woodard & Curran to prepare a set of detailed bid documents to ensure equal bidding, which is beyond the scope of this assessment and would involve additional engineering fees.

For budgeting purposes of the concrete repair work only (not including the painting of the steel Tower), we recommend that the Town plan for a total construction/repair cost in the range of $26,500 to $28,500, not including engineering. The following provides a further breakdown of these construction costs:

- $2,495 - Mobilization, demobilization, site & blasting equipment set up.
- $10,445 - Surface preparation, pressure washing, brush blasting, concrete demolition, formwork, and concrete placement for the four column piers
- $12,225 - Surface preparation, pressure washing, brush blasting, concrete demolition, formwork, and concrete placement for the center riser foundation.
- $1,975 - Application of elastomeric polyurethane waterproof membrane system over the four column piers and center riser foundation.
- The above price breakdowns include a single mobilization with all work being done concurrently. If broken up separately, additional mobilization costs would need to be added.
- The above price includes one preliminary site visit by Knowles for the exploratory test pitting, with minor excavation being provided by the Town Public Works Department.
- Labor & material costs for the replacement of existing corroded rebar, if identified, is not included.
- Contractor estimates the job will require 11-12 full working days plus 2 days for shop load time and mobilization/demobilization.

- Utility Building demolition is not included in the above estimate. If performed during the same mobilization as the repair work, the building superstructure (above concrete floor level) could be demolished down to the concrete foundation for an additional $6600, leaving the floor slab and frost walls in place. Electrical demolition would not be included and would need to be provided by an electrical contractor.

Repair work of this nature can often be unpredictable, depending on the quality of the contractor and amount of unforeseen issues that arise. For example, for this project the amount and depth of surface deterioration is an unknown, as well as how much rebar exposure and possible replacement may be needed. These things will not be fully clear and accurately quantified until the existing concrete is prepared and surface preparation is complete. No rebar replacement is included in the above pricing and hopefully there will not be any required, but there is that possibility. Therefore, we recommend that the Town also budget for a contingency of 20% to account for potential unknowns.

Woodard & Curran greatly appreciates this opportunity to provide continued structural services to the Town of Harpswell, for whom I recall doing several design projects at the Town's Transfer Station many years ago. We believe that these repair recommendations combined with teaming with Knowles will result in a correction of the current deterioration problems. Further, we believe we have proposed a positive repair strategy that will provide long-term protection, restore structural integrity to the foundations, and greatly extend the life of this structure. We would be happy to meet with the Town on site along with Knowles, so that we can further discuss implementation of this repair project to best suit the Town's needs.

Cc: Nate McLaughlin PE, Sr Project Manager and Morgan Stuart, Engineer from Woodard & Curran

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